largest orders being *Compositæ* (143 species), *Cyperaceæ* (105), *Gramineæ* (88), *Rosaceæ* (52), *Leguminosæ* (45), *Menthaceæ* (which name looks unnatural —39), *Ranunculaceæ* (36), *Cruciferæ* (36), *Orchidaceæ* (34), and *Liliaceæ* (31). The largest genera are *Carex* (72 species), *Solidago* (20), *Aster* (19), *Polygonum* (16), *Salix* (14), *Potamogeton* (12), *Viola* (11), *Habenaria* (10).

The Timber Line.—In Dr. Rothrock's valuable report on botany, recently published by the "Surveys West of the 100th Meridian," the author quotes Dr. Englemann's statement that "there is little or no increase in altitude in the timber line toward the equator, in our western hemisphere, south of the 41st parallel of north latitude."

This statement is approximately true regarding the Rocky Mountains, owing, however, not to any general principle, but to what may be termed an accident of topography. Even here a decided rise is observable from 41° to 39° of latitude. In the Sierra Nevada, the Basin and Wahsatch Ranges, the statement does not hold good, the timber line rising rapidly as the latitude decreases. Again, on the volcanic peaks of the Mexican plateau, the timber line is higher by several thousands of feet than it is anywhere in the United States.

Barring the prohibitive circumstances of absence of soil and moisture, the height of the timber line is purely a question of temperature. The latter is a function of the latitude, the elevation, and the mass, of the country in the neighborhood. A great mass of country, if raised to a considerable height above the sea, as in the case of the great Cordilleran plateau of the West, carries up with it, to a certain extent, the isothermals A glance at Mr. Schott's admirable isothermal charts amply illustrates the general fact. Washington, D. C., has a mean annual temperature of 55° Fah., while Denver, Col., a fraction of a degree farther north, and at an elevation of 5,300 feet, has a mean temperature, not of 37°, as the height might indicate, but of 49°.

Therefore, in considering the height of the timber line, we must regard the mountain ranges in connection with the plateau upon which they stand, their latitudes, heights, and masses, or what, in a measure, sums up these three, their temperatures, as it is by these that its height is determined.

Looking at the subject from this point of view, a fair comparison may be instituted between the timber line in different latitudes and on different ranges in the same latitude.

The actual elevation above the sea level of the timber line in the Cordilleras of North America ranges from 6 or 7,000 to 12,000 feet. It is lower in the Coast and Cascade Ranges of Washington Territory, where it is at about the former figures. Following the Cascade Range southward into Oregon, the timber line rises to a

height of 7,000 to 8,000 feet. It continues to rise as we trace it southward into California, being on Shasta and the neighboring mountains 8,000 feet above the sea. On the high sierras of Eastern-central California, forests grow to 10,000 or 11,000 feet, while the San Bernardino and other ranges of Southern California do not reach the upper limit of forests.

Few of the ranges of Nevada reach the timber line, which is at a height of 9,000 feet in the north up to, probably 11,000 feet in the southern part of the State.

In Arizona, probably none of the mountains reach the timber line, except the volcanic group known as the San Francisco Mountains, and the Sierra Blanca. On these the timber line is between 11,000 and 12,000 feet.

In New Mexico, it averages about 12,000 feet above sea level. There is little variation between the northern and southern parts of the territory, as the higher annual temperature of the southern part is fully compensated for by the greater altitude of the plateau in the northern part.

In Colorado, it ranges from 12,000 feet in the southern part to 11,000 in the north. It is highest in the great mass of the San Juan Mountains and in the Sangre de Cristo range, and lower in the northern portions of the Park and Front Ranges.

In Southern Wyoming, in the Park range, which is the only one in this portion of the territory which rises above the limit of timber, this limit is at about 11,000 feet. In the Wind River and Teton Ranges, in the northwestern part of the territory, it is at an elevation of 10,000 to 11,000 feet.

In Montana and Idaho, the limit of timber is, in general, from 9,000 to 10,000 feet, being highest in the south, and lowest near the northern boundary.

In the Uinta and Wahsatch Ranges of Utah, it is about 10,000 feet rising somewhat above this figure in the southern part of the latter range.

Thus it is seen that in the same latitude, there is a very marked difference in the height of the timber line. The less the elevation of the surrounding country, other things being equal, the lower is the limit of timber.

This suggests a farther point. The upper limit of timber must have approximately the same mean annual temperature everywhere. Of course it will differ to a slight extent in different localities, owing to difference of exposure to wind and sun, but these are mere local circumstances, not effecting the general principle. The determination of this temperature accurately is, without direct observation, of course, impossible. I have, however, computed it approximately from such data as are available, and have found tolerably close accordance among the results.

The mean annual temperature decreases about 1° Fah. for each 300 feet of abrupt ascent. In the case of Pike's Peak and

Colorado Springs, where the difference of elevation is more than 8,000 feet, the change is 1° for each 295 feet. In the case of Mt. Washington and Shelburne, New Hampshire, it is 325 feet for each degree. The former case is the most favorable in every respect, and as most of our results are drawn from the western region, I have adopted, as a round number, 300 feet.

Now, if the average mean annual temperature all around the base of a mountain were known, it would be a very simple matter to determine, with some accuracy, the temperature at timber line, knowing its height and the mean height of its base. The nearest approach which can be made to this, is to assume that the station or stations at or near the base, represent the average climate, a supposition which, in many cases, is by no means correct. Using, however, in the manner indicated, such data as are at hand, I have obtained the following results:

Mountains, etc.	Height of timber line, feet.	BASE STATION.			Temperature at timber line.
		Name.	Height in feet.	Mean an. tem.	
Cunningham Pass, Colo..	11,500	Fort Garland,	7,945	43deg	31deg
Mt. Lincoln, Colo.,	12,051	Fairplay,	9,965	38 "	31 "
Mt. Silverheels, Colo.,	11,549	"	9,965	38 "	33 "
Mt Guyot, Colo.,	11,811	"	9,965	38 "	32 "
Mt. Powell, Colo.,	11,660	White River Agency,	9,491	45 "	28 "
Pike's Peak, Colo.,	11,720	Colorado Springs,	6,032	48 "	29 "
Gray's Peak, Colo ,	11,100	Denver,	5,244	48 "	29 "
Wahstach Mts., Utah,	10,000	Salt Lake City,	4,350	52 "	33 "
Mt. Washington, N. H.,	4,150	Shelburne, N. H.,	700	42 "	30 "
Mt. Marcy, N. Y.,	4,851	Somerville, N. Y.,	412	45 "	30 "
" "	4 851	Plattsburgh, N. Y.,	180	44 "	29 "
Mt. Blackmore, Mont.,	9,550	Fort Ellis, Mont.,	4,935	44 "	29 "
Mt. Bridger, Mont.,	9,002	" "	4,935	44 "	31 "
Mt Delano, Mont.,	8,784	" " "	4,935	44 "	31 "

The mean of these results is 30.4°, and this is probably very near the true mean annual temperature of the timber line. The better the conditions of the determination, the nearer are the results to this mean. Mts. Blackmore and Bridger are very good cases, being on the border of the Gallatin Valley, in which Fort Ellis is situated, and but very few miles distant from the latter. Mts. Lincoln and Silverheels are also admirably situated with respect to Fairplay, but the annual temperature of the latter station is not well determined. Pike's Peak and Colorado Springs make an excellent pair of stations, being but ten miles apart, and the annual temperature at the latter place being well determined by the observations of the Signal Bureau. On the other hand, Mt. Powell and the White River Agency are widely separated by many miles of high plateaus, which may materially change the conditions of the temperature about the mountain.

Should this result, when tested by a wider range of observation, hold good, it will afford a very valuable and easily obtainable isothermal, and also enable one to estimate the height of the timber line from thermometric stations at the bases of mountain ranges. —HENRY GANNETT in *Am. Jour. Sci.*

A Colossal Album of Living Ferns, by J. G. Lemmon.—Explorers in mountainous countries sometimes encounter what the frontier's-men call "rock-traps"; if on the Pacific coast, "box-canyons."

Generally terminating a ravine, and with high precipitous walls on either hand, they bar farther ascent, and the explorer has no choice but to retreat.

If, however, the party is a lover of Nature he is apt to pause and examine these *cul-de-sacs* with more or less of interest and profit. These box-canyons sometimes may be likened to immense half-opened books, resting on end and slightly inclined against a mountain.

Occasionally a tier of them may be found encircling the top of a mountain like a revolving book-rack in a reference library. In these ponderous tomes of Nature's original scriptures what solid, fundamental, pre-historic facts may be read by the educated mind. The geologist is sure to discover remarkable placements of rock-strata, or the no less interesting omission of normal relations. The paleontologist may discover shells, casts of fossil parts of animals and plants as he shatters the rocks with his hammer.

If in a reputed region of the precious metals, the first to explore minutely, these open volumes, is the eager, intrepid prospector, gladly availing himself of the chance to examine without the aid of pick and shovel, the exposed rocks to trace, if any there be, the indications of ore. The zoologist will often find rare insects, reptiles, birds or beasts haunting these secluded places.

But if a stream of water cascades down the chasm or even if enough trickles over the walls to keep the interstices moist, the botanist, more than all others, will be certain to find much of interest in the peculiar flora which these conditions always produce.

It is such a secluded, magnificent and well-watered natural conservatory, like a colossal album of living plants, that the writer discovered last week, here in the heart of the lofty, rock-ribbed, heavily-forested Huachuca mountains of southern Arizona. The results of the adventure may justify a detailed description.

It was about 11 A. M. of a hot August day, when as I turned an angle of a deep ravine, a stupendous gorge opened before me not 20 rods distant, its dark, vertical walls over 2,000 feet high, seamed and furrowed laterally and vertically; these containing rank on rank of plants of various size and hue, while over all water dripped in a shower of pearls.

The grandeur of the scene fixed me to the spot for a moment